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TRANSPARENT DISPLAY DEVICE HAVING A MINIMIZED BEZEL

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the priority of Korean Patent Application No. 10-2013-0160755 filed on Dec. 20, 2013 in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND

Field of Technology

The present disclosure relates to a transparent display device and a transparent organic light-emitting display device with reduced width and thickness of their bezels.

Description of the Related Art

An organic light-emitting display (OLED) device is capable of emitting light and thus does not require an additional light source, unlike a liquid crystal display (LCD). Therefore, an OLED device can be made lighter and thinner than a LCD device. Further, an OLED device has advantages in that it consumes less power, realizes better colors and has good response speed, view angle and contrast ratio (CR) than a LCD device. For at least these reasons, an OLED device is considered as the next generation display.

SUMMARY

A “transparent display device” means that a viewer can see a background through the display along with images displayed thereon. The pixel area of a transparent OLED device can be divided into a light-emitting area in which organic light-emitting elements emit lights to display images, and a transparent area through which external light passes. Transparency of the transparent OLED device is obtained by the transparent area

Typically, the substrate of a display device comprises a display area and non-display area. Opaque elements such as a battery and a plurality of circuit boards are disposed under the display area of the substrate. Therefore, even when the display area is transparent, it is difficult to make the display device transparent. In order to achieve a transparent display device under the given condition, it can be conceived to place opaque elements on one side of the display device all together, or to divide them into two parts to place one on either side of the display device.

When two circuit boards are separately placed on two sides of the transparent display device, the elements on one circuit board are electrically connected to the elements on the other circuit board via an additional interconnection film, which is a separate element from a substrate. When the additional interconnection film is disposed on the side portions of the substrate, the bezel size of the transparent display device is increased. Also, the thickness of the interconnection film can increase the thickness of the transparent display device. In addition, when a printing process is used to manufacture the interconnection film, it is difficult to form the lines of the interconnection film in a multi-layered structure. Because the lines are spread apart, the width of the interconnection film is increased proportional to the width and/or number of the lines. This can increase the width of the bezel of the transparent display device even further. In view of this, a novel transparent display device and a transparent OLED device with reduced width and thickness of their bezels is described herein.

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An object of the present disclosure is to provide a transparent OLED device with reduced width of its bezel by utilizing existing lines formed on a substrate of the transparent OLED device, without an additional interconnection film for electrically connecting elements disposed on separate circuit boards.

Another object of the present disclosure is to provide a transparent display device and a transparent OLED device with reduced width of their bezels by connecting elements disposed on one side of the transparent display device to elements on another side via lines directly formed on a substrate of the transparent display device, instead of a separate interconnection film.

Yet another object of the present disclosure is to provide a transparent display device and a transparent OLED device in which lines for connecting elements on two separate circuit boards are provided on the transparent substrate to reduce the size of the bezel without undesired noise between the lines.

The objects of the disclosure are not limited to the aforementioned objects, and other objects, which are not mentioned above, will be apparent to those skilled in the art from the following description.

According to an aspect of the present disclosure, there is provided a novel transparent organic light-emitting display device. The transparent substrate includes a display area and non-display area adjacent to the display area. An organic light-emitting element is disposed on the display area of the transparent substrate. A first power line is disposed on the display area of the transparent substrate. The first power line supplies power to the organic light-emitting element. A first circuit board comprises a first power supply provided on a first side of the transparent substrate and a second circuit board comprises a second power supply provided on a second side of the transparent substrate. The first power supply is configured to receive power from the second power supply via the first power line.

No additional interconnection film to supply power to the first power supply is required, and thus the width of the bezel can be reduced.

According to another aspect of the present disclosure, there is provided a novel transparent display device. The transparent display device includes a transparent substrate having a display area and a non-display area disposed on the periphery of the display area. A first substrate and a second substrate are respectively connected to a different side of the transparent substrate. A plurality of connecting lines is disposed on the non-display area of the transparent substrate. The plurality of connecting lines electrically connects a first element on the first substrate and a second element on the second substrate. By forming the plurality of connecting lines on the non-display area of the transparent substrate, the width of its bezel can be reduced, compared to when an additional interconnection film is employed.

The detailed aspects of other embodiments are included in the detailed specification and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1A is a simplified plan view of a transparent OLED device according to an exemplary embodiment of the present disclosure;